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Application News

DPiMS™-8060 Probe Electrospray Ionization Mass Spectrometer

Using the DPiMS-8060 Mass Spectrometer to Analyze Drugs in Plasma (2) -A Quantitative Analysis of Abiraterone-

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User Benefits

- The concentration dependence of drugs in plasma is easily analyzed with this method.
- The analytical results obtained are unaffected by column condition or degradation.

■ Introduction

Measuring the concentration of drugs in blood or plasma is a type of analysis frequently performed in the context of research and clinical sampling. Accordingly, techniques are needed for obtaining results quickly and easily. Currently, LC/MS systems are typically used to measure drug concentrations in samples. However, because of the columns used in LC/MS systems, matrix components originating from metabolic products, such as proteins in blood and plasma, must be carefully removed. If the samples are not pretreated in this way, they can cause degradation or changes to the condition of columns, which can affect the analytical results. Furthermore, inadequate pretreatment of samples can lead to instrument contamination, increasing the frequency of maintenance required.

This article introduces an analysis method using the LCMS-8045 system equipped with the DPiMS-8060 probe electrospray ionization (PESI) unit. The concentration of abiraterone in commercial plasma is then measured with only simple deproteinization pretreatment.

■ Principles behind the PESI method and Applicable samples

When an LC/MS system is used to analyze drugs in plasma, the deproteinization process must be performed very carefully to avoid degradation of flow lines include injector and the column. Therefore, the process from pretreatment to analysis takes approximately 30 minutes per sample, although the time can vary depending on the mobile phase and analytical method used.

The PESI method used here is a direct ionization technique that does not involve the use of a column. This eliminates any impact on the analytical results due to column degradation. Furthermore, only a few dozen pL of solution are analyzed per analysis, this method minimizes instrument contamination and the impact of matrix effects that could interfere with ionization. Given its advantages, the PESI method is ideal for simple measurements such as measuring drug concentrations in samples.

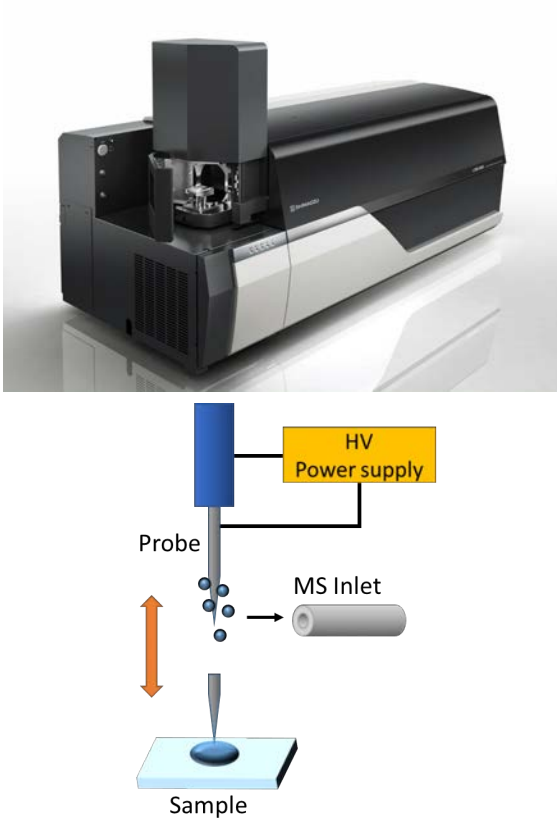
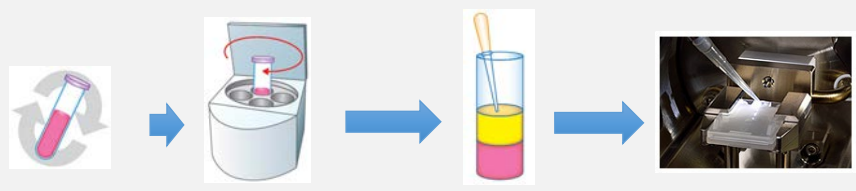


Fig. 1 DPiMS™-8060 System and the Principles behind the PESI Method



Analysis is completed in about 10 minutes per sample

Step 1: Add 100 µL of LC/MS grade ethanol to 100 µL of plasma and mix in a vortex mixer for 10 seconds.

Step 2: Centrifuge at 10,000 g for five minutes to remove any proteins.

Step 3: Collect the supernatant.

Step 4: Add 10 µL of the supernatant to a specialized sample plate and analyze.

Fig. 2 Sample Preparation Process

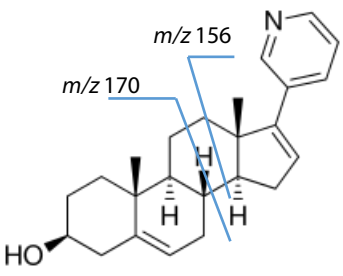


Fig. 3 Abiraterone Fragment Ion Structure

■ Abiraterone Measurement Results

The concentration of abiraterone in plasma was measured (Fig. 3). Although plasma contains a large number of matrix components that interfere with ionization, this example confirmed that the PESI method can be used to quantify concentrations in plasma under such conditions.

To established analytical conditions of abiraterone, a standard sample of abiraterone was dissolved in a 50 % ethanol solution and then analyzed. In addition, the sample was measured with a product ion scan in positive ion mode to detect abiraterone metabolites. As a result, specific fragment ions were detected at *m/z* 170 and 150 (Fig. 3 and 4). The *m/z* 150 ions were used for quantitative analysis, with *m/z* 170 used as the reference ion.

■ Quantitative Analysis of Abiraterone in Plasma

A quantitative analysis of abiraterone in plasma was also attempted. Samples were prepared as per the process illustrated in Fig. 2.

Plasma mixtures with various final concentrations of abiraterone were prepared, and equal amounts of ethanol were added before mixing in a vortex mixer. The mixed solutions were centrifuged, and then collected supernatant for use as analytical samples. Fig. 5 shows the results of using the DPiMS-8060 system to analyze the samples in MRM mode.

The calibration curve for plasma with abiraterone added was good linearity over the concentration ranges from 2 to 400 ng/mL with $R^2 = 0.9861$ coefficient of determination. In terms of variability, except for the 2 ng/mL value, the %RSD value for concentration measurements within the linear range was at most approximately 20 %, which is more than adequate for quantitative analysis. In this method, the analysis time was approximately 10 minutes per sample including pretreatment process. These results suggest that quantitative analysis could be accomplished within a short time.

■ Conclusion

This method shows that abiraterone in plasma can be quantification analysis using the DPiMS-8060 mass spectrometer (Fig. 5). Furthermore, it shows that the time required for analysis, including pretreatment and measurement, can be significantly shortened to about 10 minutes per sample.

This article also demonstrates that the DPiMS system can be used with the techniques described to quantitatively analyze target substances in solvents that contain a variety of matrix components. Subsequent usage in analyzing clinical samples is thus anticipated.

■ Acknowledgements

This article was prepared in collaboration with Takehiro Inoue at Kyoto University. His assistance is deeply appreciated.

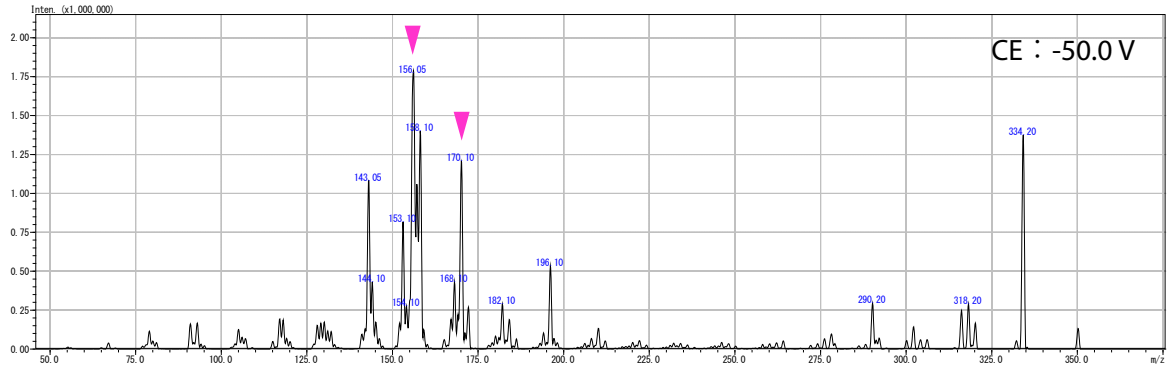
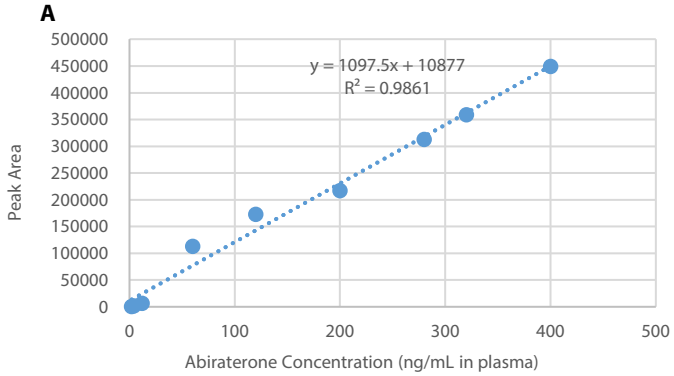


Fig. 4 Measurement Results for Abiraterone Standard Sample (5 ppm)



B

Abiraterone Concentration (ng/mL)	Mean Peak Area	SD	%RSD
2	690	212.3	30.8
4	1439	194.3	13.5
12	6651	304.9	4.6
60	112840	17144.2	15.2
120	172832	5437.3	3.1
200	216994	6537.4	3.0
280	312745	21145.7	6.8
320	358782	16537.9	4.6
400	449258	9537.8	2.1

Fig. 5 Measurement Results for Abiraterone in Plasma
A: Calibration Curve for Abiraterone Concentration in plasma;
B: %RSD Value Calculated from Mean Area and Standard Deviation (SD) Values for Each Concentration

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